

Psychophysiological Correlates of Communication, Gravitation and Unity

The Syntergic Theory

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The syntergic theory postulates that the brain creates an energetic field (the neuronal field) that expands into space, interacts with the space-matter continuum, is able to change the informational content of the latter and thus affects other neuronal fields and physical forces. According to this theory, gravitation is a by-product of an alteration in the informational content of the space-matter continuum, and human communication is based on neuronal field interactions.

It is proposed that a brain operating in a highly coherent mode and in an abstract fashion (high neurosyntergic brain) creates a neuronal field that would decrease the gravitational forces around it. By the same token, a brain functioning in a relatively noncoherent mode and in a concrete fashion (low neurosyntergic brain) creates a neuronal field that could shift the informational content of the surrounding space toward that modality.

In the syntergic theory, experience is considered as the interaction between the neuronal field and the energetic (syntergic) organization of space. A high neurosyntergic brain will experience unity, while a low neurosyntergic brain will experience reality from the vantage point of a personal ego.

A high neurosyntergic brain would increase the synergy of space and thus could affect the experience resulting from the interaction of other neuronal fields with that altered space.

This approach is the one that contemporary physics requires in order to be able to incorporate experience into its realm and thus expand its limits to include life and consciousness. I suggest that this step will allow physics to find the elusive unified field.

A number of experiments have been designed in order to test these ideas; the results of some of them are here reported.

1. THEORETICAL INTRODUCTION

A few months before his death, Zen master Shunryu Suzuki said:

... Nothing comes from outside your mind. Usually we think of our mind as receiving impressions and experience from outside, but that is not a true understanding of our mind. The true understanding is that the mind includes everything; when you think something

comes from outside, it means only that something appears in your mind. Nothing outside yourself can cause any trouble. You yourself make the waves in your mind. If you leave your mind as it is, it will become calm. This mind is called 'big mind'.

If your mind is related to something outside itself, that mind is a small mind, a limited mind. If your mind is not related to anything else, then there is no dualistic understanding in the activity of your mind. You understand activity as just waves of your mind. Big mind experiences everything within itself. Do you understand the difference between the two minds, the mind which includes everything, and the mind which is related to something? Actually they are the same thing, but the understanding is different, and your attitude towards your life will be different according to which understanding you have.

That everything is included within your mind is the essence of mind. To experience this is to have religious feeling. Even though waves arise, the essence of your mind is pure; it is just like clear water with a few waves. Actually water always has waves. Waves are the practice of water. To speak of waves apart from water or water apart from waves is a delusion. Water and waves are one. Big mind and small mind are one. When you understand your mind in this way, you have some security in your feeling. As your mind does not expect anything from outside, it is always filled. A mind with waves in it is not a disturbed mind, but actually an amplified one. Whatever your experience is an expression of big mind. (Suzuki, 1977)

Can we postulate some physiological correlative of Suzuki's big mind?

The existence of a unified big mind, implies that space as a concept and as a physical reality is no more than an illusion. If this is true, then also, the concept of distance must be abandoned.

Equally true, the existence of a unique mind, if accepted, makes cumbersome the reality of individual minds and isolated brain structures.

Since science is so cautious in its acceptance of new hypotheses, postulates and theories, to incorporate within its structure the idea of a unique mind, it would be necessary to prove that:

- i) Brain activity exists outside the skull.
- ii) This extra-skull activity establishes a functional connection between different brains and unites them.
- iii) Space is a component in our brain's perceptual construction of reality.
- iv) A fundamental energetic matrix exists behind every material object and physical manifestation.
- v) The feeling of individuality can be transcended to gain access to the perception of unity.

Let us examine each one of the aforesaid postulates, in order to discuss their validity.

1.1 Brain activity exists outside the skull

It is obvious that the existence of extra-skull brain activity is a basic condition for all subsequent discussions about the unique mind. Without extra-skull activity,

the hypothesis about the existence of a unique big mind is unacceptable.

There are at least two pieces of evidence that support point 1.1. First, the human magnetoencephalogram (Reite, Zimmerman, Edrich and Zimmerman 1976). Second, the recent discovery of a relationship between gravitational changes and brain activity (see section 5 below).

Both the magnetoencephalogram and the gravitational effect show that there must be some kind of a field emanating from the human skull and affecting the surrounding space (see section 5 below).

It has been postulated (Grinberg-Zylberbaum, 1981a, b) that as a result of all the neuronal interactions in 50 milliseconds of brain activity (the duration of the present interval, see Torres and Canseco, 1980), a synergic field (the neuronal field) is created inside the brain microstructure, and later on spreads into the surrounding space.

In relation to the aforesaid micro-structure, K.H. Pribram writes:

The aggregate of slow potentials present over an extended location at any moment can be described as a state which has a micro-structure. The arrival of impulses at ephaptic or synaptic junctions is never a solitary event. Axonal terminations are usually multiple, i.e. axons branch at their ends. As many as 1000 synapses may characterize the junctional possibilities between a pair of neurons. Dendrites are tree-like almost by definition, displaying many fine fibered branches which crisscross, making multiple contacts among neurons, contacts which for some cells (e.g. the amacrine of the retina) include structured synapses. Thus ephaptic and synaptic events, those that are composed at the junctions between neurons, form a pattern. Inferences about the nature of such a pattern can be made from the known fine structure of the brain and the electrical activity recorded from it. Several such inferences suggest that these patterns make up wave fronts ... (Pribram, 1977).

These wave fronts must be three-dimensional and in some cases must involve large portions of the brain. The neuronal field emerges as a result of the global activation of the brain microstructure of which the above mentioned wave fronts are only part.

Furthermore, in the experiment about the relationship between brain activity and gravitational forces mentioned before, it was found that a non-local and global change in inter-hemispheric coherence ('coherence' is defined as a brain state in which similar EEG patterns and similar evoked potentials are recorded simultaneously in both hemispheres) correlated with gravitational changes. A detailed description of this experiment will be presented in section 5.

A global change in brain activity is probably more related to a synergic field emergence than a local EEG alteration.

A theoretical construction (the synergic theory, Grinberg-Zylberbaum, 1979, 1980a, 1981a, b) dealing with the neuronal field will be discussed later on in this article.

1.2 This extra-skull activity establishes a functional connection between different brains and unites them

To accept this postulate, it is first necessary to prove that a real and direct intercourse between brains exists without the use of known sensory interactions.

Evidence that during human communication direct non-sensory interchanges of significant messages occur, has been obtained (Grinberg-Zylberbaum, Cueli and Szvdo, 1978) and it will be discussed and extended in the experimental section of the present paper. Here, it is enough to say that the aforesaid direct communication occurred whenever a high correlation between individual inter-hemispheric coherences appeared in the brains of the subject during the communication sessions.

The fact that both direct communication and gravitational changes occur in direct correlation with the brain modifications in inter-hemispheric coherence supports the idea about the existence of the neuronal field and its physiological role as a device to unite the activity of individual brains.

The postulated connection between different brains through their neuronal fields must involve some medium or matrix in which the interaction between neuronal fields could happen. One possibility in regard to this hypothetical medium is the quantum field described by contemporary physics (Capra, 1976). This last hypothesis will be discussed in 1.4 below.

1.3 Space is a component in our brain's perceptual construction of reality

In the interaction between our retinal receptors and the energetic information contained in the space of the interaction, a transformation of the quantum field matrix occurs. In this transformation, the information contained in the quantum field is transferred first to local, analogical microchanges in membrane potentials and later on into propagated, digital action or spike potentials in the axons of the optic nerve.

Perceptual reality as we know it is neither the reality of the quantum field, nor the neuroelectric reality of our brain activity. Further energetic transformation must be postulated in order to explain our perceptual experience. When the propagated information carried through the digital messages in the optic nerve reaches deeper structures in our brain, at least two families of further energetic transformations occur. First, convergence-divergence networks concentrate digitalized messages in "neuro-algorithms" (Grinberg-Zylberbaum, 1976a, b; 1981a). These neuro-algorithms unify disperse activity in logical neuronal patterns (Grinberg-Zylberbaum, 1976b). The neuro-algorithmic processes are the basis of concept formation, imagination and meaning (Grinberg-Zylberbaum, 1980a).

If an energy system located in the quantum field is capable of being neuro-

algorithmized by the brain, it will be perceived as a concrete object. If an energy system is so complex as to exceed the neuroalgorithmic capacity of the brain this organization will not be perceived at all or it will be seen as a blurred configuration. This last is the case for space. In reality, space is so complex and full of information that our brain is only capable of decoding the little portion of it transceiving our retinal receptors. If we could decode and perceive simultaneously all the portions of space, we could see a solid. Thus space as transparent and space as an empty and dividing entity is a delusion.

Second, besides the neuroalgorithmic processes, wave fronts (Pribram, 1977) appear as slow potentials in the dendritic microstructure of the brain. If the neuroalgorithmic logic has as its function the management of a digital universe, the wave fronts activation deals with the analogical universe inside our brain. Both unify disperse activity but serve different functions. The neuroalgorithmic logic deals with linear problem solving processes, while the wave front activity is the basis of both the neuronal field and our perceptual experience.

Furthermore, an interaction between the neuroalgorithmic activation and the wave front excitation can be conceived as a means to modulate extremely complex patterns of energy. These patterns must be incorporated into the morphological three-dimensional structure of the neuronal field.

A good example of patterns developed through complex interaction are the Cymatics patterns (Jenny, 1973). In them, extremely complex forms of patterns are activated when a vibrating field (i.e. a sound) interacts with a metal plate on which fine lycopodium powder has been deposited. These Cymatic patterns follow very interesting laws. For example, with an increase in the frequency of the field, the complexity of the Cymatic pattern increases but a fundamental form in it is maintained.

According to the synergetic theory (Grinberg-Zylberbaum, 1978, 1979, 1980a, 1981a, b) a Cymatic-type interaction occurs between the neuronal field and the quantum field. This interaction is the basis of our perceptual experience and of experience in general.

Therefore, both the neuroalgorithmic and the neuronal quantum field interaction processes, indicate that transparent space is only a particular level of our brain's perceptual construction of reality. Thus, a real medium of separation between material objects, brains or energetic fields, does not exist.

1.4 A fundamental energetic matrix exists behind every material object and physical manifestation

Specialists in the physics of elementary particles (Capra, 1976) have been claiming that the sudden appearance of particles from the seeming nothingness, as well as the opposite, the disappearance of elementary particles in space as a result of interactions, points towards the idea that a fundamental energetic matrix exists

behind the universe of known particles and objects. These scientists have called this matrix "the quantum field". They claim that when activated, this field changes in one or in several of its locations, changing some parameters (e.g. frequency) of itself. This parametric change is detected as an elementary particle. Since these elementary particles are the basis of every material manifestation, every object, brain, body, etc, is a particular or specific manifestation of the same field.

1.5 The feeling of individuality can be transcended to gain access to the perception of unity

All the great mystics in human history have claimed that the perception of unity is not only possible, but that it is the most natural and truly human feeling (Vivekananda, 1963, 1975; Cooke, 1970; Khan, 1978). Furthermore, their description of the state of unity does not involve losing the feeling of the self but expanding it (Santa Teresa, 1578, 1976) into everything (Suzuki, 1977). In other words, individuality is not lost during the perception of unity, but is truly transcended. If the perception of unity exists and the state of unity is real, then there must be reliable neurophysiological techniques that could be used to activate both, the perception and the state of unity. Furthermore, a neurophysiological explanation of the state of unity and its perception must exist.

In the following and last section of this theoretical introduction, answers to these two questions will be sought.

2. A TECHNIQUE TO STIMULATE THE STATE OF UNITY

For many years, our laboratory has been searching for reliable neurophysiological techniques to stimulate the perception and the state of unity (Grinberg-Zyberbaum and Riefkohl, 1980). We tried several modalities of the EEG biofeedback technique (e.g. alpha with closed eyes, alpha with open eyes, theta with closed eyes and theta with open eyes) without success. Then we decided to use a very sophisticated evoked potential biofeedback technique (Grinberg-Zyberbaum, 1980a) in which a subject could actually see his own evoked potential components in order to relate his subjective experience to them. The results were fascinating and will be published elsewhere (Grinberg-Zyberbaum and Ornelas, 1980). Here, it is enough to say that very well trained subjects are able to correlate their subjective experience with even the low latency primary components of the visual evoked potentials as if their focal attention could be localized in the beginning of the brain decodification of incoming signals. Fascinating as it was, the technique failed to stimulate unity.

Then, we decided to present to our subjects 200 msec. samples of their EEG spontaneous activity recorded from four different bipolar derivations on the skull. Two derivations from the anterior and posterior locations of the right hemisphere, and the other two from homologous places on the left hemisphere. A scale was constructed that allowed us to quantify the simultaneity between pairs of EEG patterns. Thus we were able to measure the degree of:

- i) Anterior inter-hemispheric coherence.
- ii) Posterior inter-hemispheric coherence.
- iii) Right intra-hemispheric coherence.
- iv) Left intra-hemispheric coherence.

The task of the trained subjects was to correlate their subjective experience with the degrees of these coherences.

The detailed results and methods are to be published in a separate paper. The important result for us here is that this technique can be used to stimulate the state and the perception of unity. In a sample of five trained subjects in 50 sessions, all of them reported that when the simultaneity between the above coherences was very high, they felt a sense of unification in themselves and in relation to others. They also reported a feeling of peace and understanding about the "delusive subject-object dichotomy" (Grinberg-Zyberbaum and Riefkohl, 1980).

In other words, a high and simultaneous inter- and intrahemispheric level of coherence (a high global coherence), correlated with the perception and the state of unity in our subjects.

Thus, the state and the perception of unity can be stimulated and learned. In this last regard, it should be said that, in order to reach the levels of coherence which correlated with the state of unity, our subjects had to train themselves very hard and for a long time (at least several months) in this spontaneous EEG coherence biofeedback technique.

We also learned that the spontaneous EEG coherence biofeedback technique does not work by itself; it is rather only a tool that can stimulate the state of unity. The real process that helps to reach the state of unity takes place at a much deeper level. Our biofeedback technique only activates this process and helps to detect very subtle subjective and hidden information.

Nevertheless, it is clear that when the aforesaid internal process reaches a level allowing the subject to perceive himself as lacking separation from everything else, a high global brain coherence appears.

We were delighted but not surprised by these findings. They corresponded well with our gravitational and communication studies results and were almost predictable from them.

3. A NEUROPHYSIOLOGICAL THEORY OF UNITY. THE SYNTERGIC THEORY

When the informational organization of space is analyzed, the direct relationship between convergence and redundancy of light information stands out as a remarkable fact (Grinberg-Zylberbaum, 1981b).

I begin this section with this statement, because the relationship between convergence and redundancy is seminal in itself and basic for an understanding of the synergetic theory and our neurophysiological approach to unity. In the synergetic theory, space is conceived as a matrix capable of concentrating information in each of its points or locations (Grinberg-Zylberbaum, 1981a). A high synergetic space is a region of space in which each location concentrates more information than a low synergetic space. A high synergetic space is a space located far away from any material object. A good example of this space is some location in extraterrestrial space far away from any star. In this space an astronaut would be able to see wide regions of the Universe through a small hole made in a piece of paper. What the eye of this hypothetical astronaut sees is the space of the hole. In this small region of space, far away from any star, large amounts of information will be concentrated.

The same observer, now located on the surface of the Earth and using the same hole, would see only a limited portion of the planet. Thus, near an object, space concentrates less information about it than it does when far away. Obviously, the relationship between concentration of information and distance is relative, and depends upon other things such as directionality. Thus, an observer on the surface of a planet is able to receive large amounts of information in the direction of the sky and (from the same spot) less information if he directs his gaze towards the surface of the planet. This means that, in a specific location of space, there is a coexistence of high and low synergetic organizations of information. The interaction of an observer with a particular region of the synergetic spectrum depends on the aforesaid direction of gaze and (as we shall see later) on the level of consciousness of the observer.

Now let us consider the relationship between concentration of information and redundancy of information. A high synergetic space, in addition to concentrating large amounts of information in each one of its locations, is more redundant than a low synergetic space. An observer located on the surface of the earth and seeing the moon while he travels has the impression that the moon follows his movements. At this distance between the earth and its satellite, the photonic-visual information that the moon reflects is highly redundant; thus, each location of the space from which the observer gazes contains almost identical information. Because what the observer perceives is the space that activates his retinal receptors and this space contains almost the same information in each one of its locations, the observer sees a moon that follows his movements. Thus,

a direct relationship between redundancy and concentration of information exists in space in general and in a high synergetic space in particular. The opposite is also true. If instead of gazing towards the moon, the observer directs his retinal receptors toward the road on which he is travelling, he will see a blurred image. At the small distance between the observer and the road, the concentration of information in each location of space that activates the retina of the observer is relatively small. Consequently, information there is distributed in a low redundancy fashion. Each location of that space activates the retina the observer with different information. In the duration of the perceptual present (50 msec. is the time necessary to build a visual image) of the observer, the resulting image will be a blurred one.

The relationship between redundancy and amount of information in high and low synergetic spaces solves the (until now) puzzling problem of the "relative movement phenomenon" in the psychology of perception.

A convergence network of information can be conceived as a fundamental feature of the informational organization of space. In this regard, the convergence organization of space and of the brain are similar (see Grinberg-Zylberbaum, 1981a), and the concept of neural algorithms could correlate with a similar algorithmic organization of information in space. Thus, a direct relationship between convergence and redundancy of information exists in space and probably also in the brain.

Some of the brain convergence operations were analyzed by A.R. Luria (1973) in his studies about the synthetic functions of the cortex. Luria stated that the synthetic operations related to the language process are represented in cortical networks and locations with more convergence power than the locations related to neuropsychological operations with a lesser degree of complexity. Even more, according to clinical observations (Luria, 1973), when a high synthetic location of the cortex is damaged, its effect upon the neuropsychological operations is more complex and extended than the effect caused by the damage of a less powerful synthetic region.

This view is (remarkably) very similar to the one that the Kabbalist Rabbi Isaac Luria offered in his analysis of the Sephirot. Each of the Sephirot is a "sphere" located near or far away from the mystical Ein Sof infinite centre of God. According to Luria the Kabbalist, consciousness can be located in different spheres. When it abides near the Ein Sof, it has more power to affect the other Sephirot than when it is located far away from the centre.

Returning to Luria, the Russian neuropsychologist, the synthetic operations seem to be almost identical to the brain neurosynergetic operations and these last ones seem to be similar to the synergetic organization of space.

A high synergetic space is a space that contains more information about itself in each one of its locations than a low synergetic space. Thus, a high synergetic space is more unified. The relationship between synergy and redundancy

points toward the same conclusion; a high redundancy space is a more unified space. A similar conclusion is reached in relation to the high neurosyntergic mode of functioning which involves a higher capacity to concentrate information and thus an increase of the abstract function. By the same token, a high neurosyntergic mode is a more unified mode. If a neuronal network could concentrate in a neuroalgorithmic logic all the information about the brain, it could unify the brain. Possibly a similar mechanism is the physiological correlate of the self.

Now, the aforesaid statements mean that different neurosyntergic levels of operation can coexist in the same human brain and in different brains, each one related to a distinctive capacity for unification. Furthermore, a unification capacity is, undoubtedly, related to a specific level of abstract thought and also to a particular level of consciousness. Thus, the neurophysiological correlates of abstract thought and distinctive levels of consciousness are precisely the physiological mechanisms related to unification. These mechanisms are the neurosyntergic ones.

I am now ready to postulate a physiological explanation of the unified mind, the Big Mind of Suzuki (1977).

I postulate that a change in the neurosyntergic level of operation of a particular brain evokes a corresponding alteration in the energetic characteristics of the neuronal field created by that brain. Furthermore, I postulate that a raising of the neurosyntergic functioning level of a human brain evokes an alteration in its neuronal field such as to cause its energetic characteristics to approach the ones observed in a high syntergic space. Thus, the possibility of an interaction between a high syntergic space and a brain increases as a result of the raising of the level of that brain's neurosyntergic level of functioning.

When a brain reaches its greatest level of neurosyntergic power, that brain becomes unified in itself. Simultaneously, its neuronal field interacts with the high syntergic spectra of space and hence with information concentrated from wide regions of the Universe. When experience is the interaction between the neuronal field and the syntergic energetic organization of space, the experience of the observer will be of a unified whole.

The physical characteristics of the interaction between neuronal fields and the syntergic energetic organization of space are completely unknown. We hope that the data that we have gathered in regard to the process of human communication will help to develop understanding of this problem.

Before the presentation of our data, let us summarize some of our basic theoretical concepts:

i) Empty space is a delusion. What we call space is in reality an energetic matrix filled with information. We only see one point of this matrix each time

that we gaze at some object. If we could see all the locations of space simultaneously, space would appear to us as a solid.

ii) A high syntergic space concentrates in each one of its locations vast amounts of information in a highly redundant fashion. A similar organization can be seen in a holographic plate (Caulfield and Lu Sun, 1970). The extreme of syntergy is a space in which each location contains information about the rest of the Universe. This space would be the mythical Aleph of Jorge Luis Borges (1970).

iii) Our human brain creates a syntergic energetic field as a result of all the neuronal interactions occurring in a finite interval of time (presumably this interval is the "duration of the perceptual present", measuring around 50 msec.).

iv) The brain field or neuronal field interacts with the syntergic organization of space, the interaction being with the corresponding spectra of the syntergic continuum most similar with the energetic morphological characteristics of the neuronal field.

v) The characteristics of the neuronal field mimic the changes occurring inside the brain. A brain with a high capacity for abstract information and a great sense of internal unification, presumably is a brain with an extended capacity for neuroalgorithmic creation through the activation of high power convergence circuits. This brain will create a neuronal field resembling a high syntergic space, i.e. with greater internal coherence, redundancy and concentration of information.

vi) Experience is the interaction between the neuronal field and the syntergic organization of space (the quantum field).

vii) When a neuronal field is capable of interacting with the high syntergic portions of space, the resulting experience will be a holistic and unified one; the observer will experience a state of unification with everything else in the Universe.

viii) Thus, a unified Mind exists and can be experienced.

Obviously, when the energetic characteristics of the neuronal field and the quantum syntergic field become identical, the two fields become One (strictly speaking, they are always One).

We decided to study the phenomenon of human communication because in it a small model of the interaction between fields could be observed and some of its manifestations recorded. We considered that when two or more human beings communicate between them, their neuronal fields interact. Furthermore, we thought that when the communication reaches a level of empathic order in which feelings, thoughts, emotions and other psychological phenomena are shared without the use of verbalizations (we call "direct" this level of communication), the similitude between the neuronal fields in interaction reaches an

identity and becomes One (once again strictly speaking they are always One). We hoped that some EEG measurements would manifest correlative changes with the neuronal field interactions.

4. EXPERIMENTAL INVESTIGATIONS

4.1 First experiment (method)

This experiment was done with pairs of subjects during a semi-therapeutic series of sessions. In each session, a veteran psychoanalyst, with more than 20 years in the practice of psychoanalysis, sat with a patient in order to establish a direct empathic communication.

Using the analyst's experience, we were able to construct a scale with which communication could be measured. This scale had ten divisions. When the communication reached a direct level, the measurement was 10. When there was a complete absence of communication, the reading was 0.

The sessions took place in a Gesell room or in a semisilent therapeutic room. A Sony video-tape recorder was used to record the movements and sounds of the pair of subjects during each session. The analyst (with the help of an assistant) viewed the tapes after the sessions and used the 10 point scale in order to construct a communication graph. Each 120 seconds a measurement was made. The criteria for each measurement were always the same and involved: movements, words, respiration rate and body messages.

Sometimes, the video-tapes were reviewed and blindly compared in order to retest the communication scale and measurements. The results of these retest-comparability checks were excellent. Only a 5 to 10 percent disagreement was found.

Simultaneously with the video-tape observations, an EEG recording of at least four monopolar derivations of each subject was done during each session. At least six sessions were held with each subject; thus, when the study was finished, we had the complete outline of the 10-20 International EEG system of derivations.

The communication technique used by the analyst varied with each subject. Sometimes it began with verbalizations and movements (limited by the wiring of the EEG cables); sometimes it was without verbalizations. In either case, the measure of communication transcended the logical aspect of the messages and took account of the empathic ones.

The EEG recordings were made using a portable eight channel EEG Alvar machine, and were analyzed without the use of any electronic computer system. This visual analysis had to be done by a human being because of the lack of availability of any pattern recognition EEG analysis type of machine.

Pairs of EEG derivations were compared for their morphological and frequency

similarities. The comparisons were made between one derivation and all the rest during one second in the same periods of the video-tape analysis. A scale was constructed in order to translate the morphological and frequency comparisons into numbers comparable with the communication ones. Thus a scale going from 0 to 100 was constructed, zero meaning complete lack of similarity and 100 complete identity between EEG patterns. In the description of Experiment 3 below, the details of this analysis and transformations are given.

All the EEG analyses were done blindly with respect to the communication analysis. Thus, the communication analysis was done without knowing the EEG analysis results and conversely, the EEG analysis was done without knowing the communication analysis results. Furthermore, both analyses were done by different experts.

Non-parametric correlation test and statistics were used.

4.2 First experiment (results)

We asked three questions when we began experiment 1:

- i) Is there any correlation between the communication level and the similarities in the EEG patterns of two brain derivations, one of the analyst and the other belonging to the patient?
- ii) Is there some relationship between the communication level and the coherence of the analyst brain or the coherence of the patient brain?
- iii) Is there any correlation between the coherence of the analyst brain and the patient brain?

The first question was answered by relating the communication level variations with the EEG patterns correlation recorded from both brains in homologous sites.

The second question was answered by relating the communication level variations with the changes in the analyst brain coherence and the patient brain coherence.

The third question was answered by analysing the relationship between the patient's and analyst's brain coherences.

Of all the correlations, the following were the only ones above 0.3:

- i) First, a positive 0.58 value of correlation was found between the communication level and the values of coherence in the EEG patterns recorded from T5 derivation from the patient's and the analyst's brain. Figure 1 shows this result. It can be seen that both variables, the coherence between brains and the communication level are highly correlated. This result means that when the level of communication between the patient and the analyst increased, the similitude

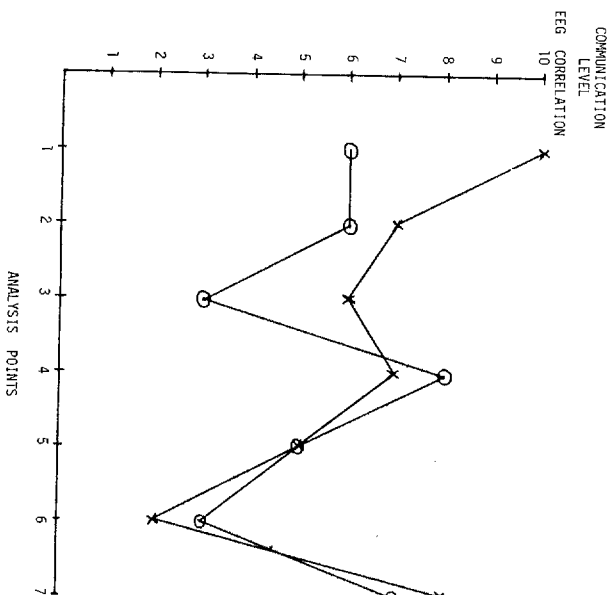


FIGURE 1 Shows the different values in the level of communication (solid line with crosses) and the values of the correlation found when the EEG activity in T5 zone of the analyst was compared with the EEG activity in T5 zone of the patient (solid line with circles). These results were obtained during a communication session in which seven points of analysis were made. The statistical analysis gave a positive 0.58 value of correlation between the levels of communication and the EEG.

between their left temporal brain derivation (T5) EEGs increased. We obtained the aforesaid result in one patient with whom the analyst had an especially good and empathic relationship. We failed to detect the same result in other subjects.

ii) Answering the second question, we found a negative 0.40 value of correlation between the analyst's C3 and C4 derivations EEG patterns coherence and the communication levels, and a positive 0.34 value of correlation between the patient's EEG coherence recorded in the same C3 and C4 derivations and the communication levels. In Figures 2 and 3 these results are shown. Thus, we found that when the communication level increased the analyst's interhemispheric C3-C4 EEG coherence diminished while the patient's interhemispheric C3-C4 EEG coherence increased.

These results were found in a patient-analyst relationship in which the analyst sensed high levels of repressed aggression.

We failed to detect the same result in other patients.

iii) Finally, we found a negative 0.44 value of correlation between the

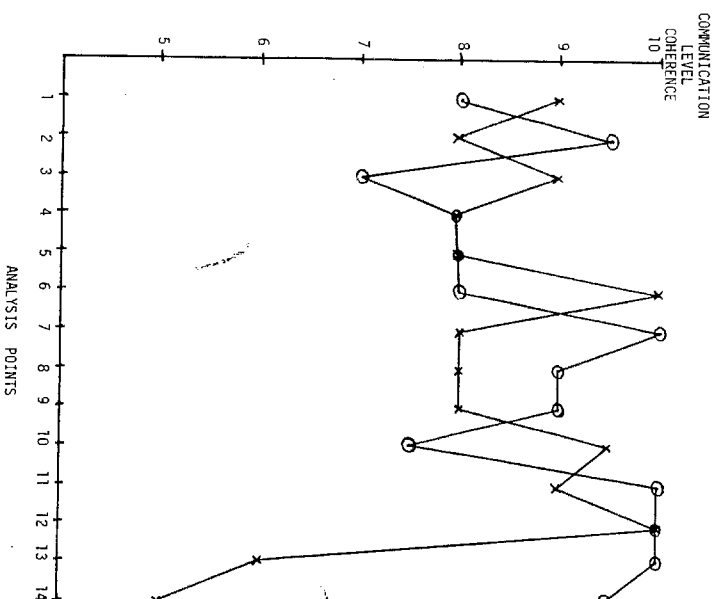


FIGURE 2 Shows the different values in the communication level (solid line with crosses) and the values of the coherence between the EEG patterns recorded from C3 and C4 derivations in the analyst's brain (solid line with circles). These results were obtained during a communication session in which 14 points of analysis were made. A negative 0.40 value of correlation was obtained between these variables. Thus, when C3-C4 level of EEG coherence increased in the analyst's brain, the level of communication with this patient diminished.

C3-C4 EEG patient and analyst coherences. This result means that a correlation exists between two subjects' brain coherences while they are in communication.

When we finished this experiment, we were convinced that some brain zones show more relationship than others with the communication phenomenon. And, that two brains in communication manifest similar patterns of EEG activity.

Simultaneously with the aforesaid conclusions, experiment 1 left us with many doubts. First, we were unable to find the same results in the six patients that we studied. Secondly, the C3-C4 EEG patterns and their coherence during the communication session were probably related to some subtle movement operation rather than with a more abstract function. Thirdly, our communication scale was unable to distinguish subtle changes in the 9 to 10 region.

We decided to make a second experiment in order to clarify our doubts and

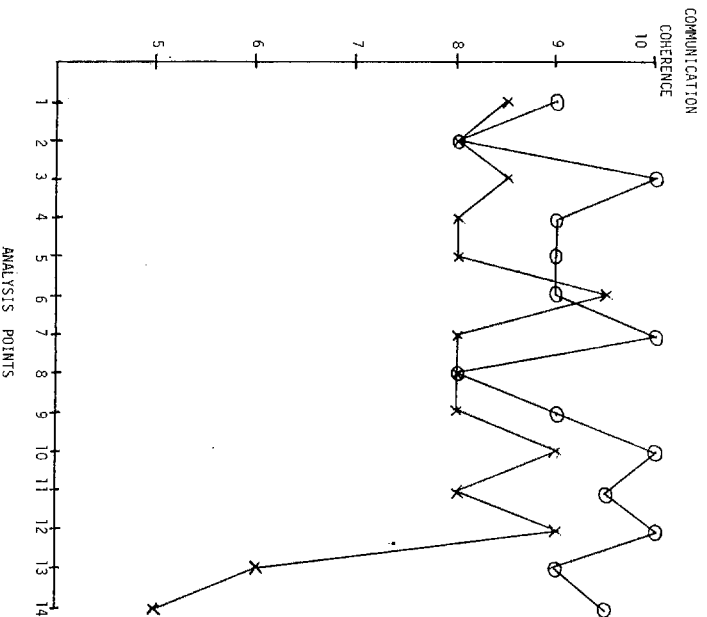


FIGURE 3 Shows the different values of the communication level (solid line with crosses) and the values of the coherence between the EEG patterns recorded from C3 and C4 derivations of the patient brain (solid line with circles). A positive 0.34 correlation was obtained between the variables.

we reviewed our video tapes and EEG recordings in order to find if the subjects that were able to establish a 9 to 10 level of communication had similar EEG patterns.

We found that in the sessions in which the analyst reported more empathic feelings toward the patient, the frontal EEG derivations of both brains showed a maintained increase of similitude, while the same region during a low empathic session showed many variations in their pattern similitude. We were not able to control for eye movements. Thus we were not able to determine how much they were involved in this last result.

4.3 Second experiment (method)

In this experiment we were able to make more controls and we introduced a third person in the communication sessions. In this second experiment, we

decided to concentrate our attention on the communication procedure. Thus, we only made bipolar frontal recordings controlling for the eye movements of our subjects.

A detailed EEG analysis during human communication was postponed for the third experiment (see below).

The aforesaid decision was taken because of the lack of the uniformity of the results obtained in experiment 1. We thought that the absence of a standardized communication procedure avoided the attainment of uniform results. Thus, in experiment 2 we developed a controlled technique for studying direct communication. The procedure was the following:

i) For several months, three subjects were trained in the voluntary activation of a feeling of pressure localized exactly in between the eyebrows. This feeling can be activated if during a meditation session the subject is instructed to concentrate his attention in the space between the eyebrows. This training procedure was used until our three subjects were able to activate and deactivate the aforesaid mild pressure feeling. Simultaneously with this training the subjects also learnt to maintain a fixed eye position, thus diminishing eye movements to a minimum.

ii) The subjects were trained to press a button connected to a circuit signalling the instant in which the pressure between the eyebrows appeared.

iii) The subjects sat inside a Faraday cage with the eyes closed and in semi-darkness. Each time that they felt the pressure activated, they sent a signal (by pressing the button) to an adjacent room in which a bipolar recording of their frontal EEG activity was taking place.

4.4 Second experiment (results)

A total of 20 sessions were made with the original three subject group and later on, 10 more sessions were done with another three subject group. Thus a total of six subjects were studied in 30 sessions.

In all these sessions except the first two with the original group of subjects and the first one with the second group, a most remarkable result was obtained, when one of the subjects felt the pressure activation, at least one of the remaining subjects and in some cases the two of them also felt the activation in themselves.

When questioned after the sessions, the subjects stated that a clear increase in the intensity of the pressure feeling appeared when they were in the group by comparison with the isolated individual activation.

They also assured us that "somehow" they knew when the activation of another member of the group occurred. Furthermore, they declared that the activation in one of them clearly stimulated the activation in the rest of the group, and that they could feel this group interaction.

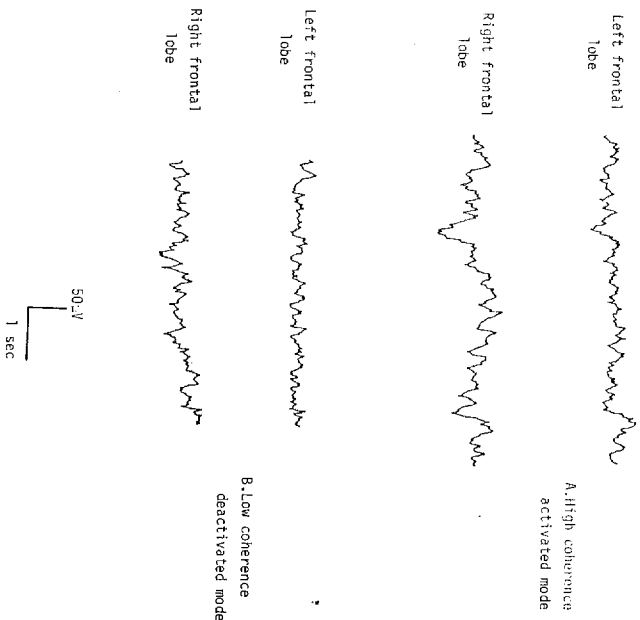


FIGURE 4 Shows typical recordings of EEG measurement taken from a subject's right frontal derivation (upper trace) and left frontal derivation (lower trace) both during activation (A) and during deactivation (B).

These results are in agreement with the existence of a direct level of communication.

In regard to the EEG recordings, Figure 4 shows a typical frontal EEG pattern during activation and in the absence of activation.

When the subjects were activated, we noticed an increase in their frontal inter-hemispheric level of EEG coherence.

4.5 Third experiment (method)

The results obtained during the second experiment, are in agreement with the observation about the existence of a direct communication level (10 in our scale) made during experiment 1. Furthermore, they (the method and results during experiment 2) established a standardized procedure for making EEG-communication studies in human beings.

Unfortunately for the methodological procedure, but thankfully for us humans, human communication transcends and is more complex than a simple pressure feeling between the eyebrows. In order to study the EEG correlates

of a truly complex human communication session without missing the flavour of the phenomenon but simultaneously assuring an adequate level of standardization and control, we decided to combine the best feature of the first and second experiments in a third experiment.

In this, experiment 3, we decided to use the following method:

- i) A total of eight subjects from 22 to 33 years of age, four women and four men were trained to evoke internal images at will, and to detect very subtle subjective changes in themselves. More than a year of intense individual and group meditation sessions elapsed until they were ready to participate in experiment 3.

The meditation techniques used during the training period were Zen, Transcendental and Sufi group meditation. These techniques stimulate a state of peace and receptivity, considered ideal for the study of communication. The detailed procedures will be published in a separate paper.

- ii) When (i) was completed, the subjects were trained to maintain their meditative state in a Faraday shielded room with EEG electrodes attached to their heads.

- iii) Groups of 2 to 4 subjects sat quietly inside this room in complete darkness while a bipolar EEG was recorded on a Beckman machine located in another room. The subjects sat comfortably in special seats without touching each other and with a minimal distance of at least 30 centimeters between them.

- iv) The subjects were instructed to close their eyes and to enter the meditative state, trying to establish communication with their fellows. Every two minutes, the session was interrupted and the subjects wrote or taped their subjective experience during that time. This 2 minutes interval was called a 'trial'. The subjects were able to report their experiences at the end of each trial because during their training period they had learned to verbalize internal states without hesitation or inhibitions. Adequate feedback at the end of each trial was given in order to inform the subjects about the occurrence of similar or identical contents in their communications.

- v) Derivations F7, F3, F4, F8, T3, T5, T4 and T6 were used. Thus, at the end of experiment 3 we had at least one record of each derivation on each subject.

- vi) Communication was measured using a scale with four values; 0, 1, 2 and 3. Zero meant absence of similarity between reports and three complete identity between reports. We considered that 3 was a direct communication value.

The reports were analyzed blindly by two independent judges in order to test for the scale and criteria compatibility. The correlation between the aforesaid independent judges was positive and had a value of 0.89 being statistically significant at the 0.05 level. In Table I the scoring of both judges is shown.

TABLE I

This table shows the scores assigned to the subjects reports by judge A (second column) and judge B (third column) during 22 trials (first column) in four different sessions. A non-parametric correlation test gave a value of 0.89 with a $p = 0.05$. Thus a very high compatibility in the measurements of the written reports was achieved.

Verbal report scoring compatibility				
Session	Trial	Judge A	Judge B	Difference
July 5 1979	1a	0	0	0
	2	1	0	1
	3	2	1	1
	4	2	1	1
	5	3	3	0
	6	2	2	0
July 9 1979	1	2	1	1
	2	2	2	0
	3	0	0	0
	4	0	0	0
	5	2	1	1
July 12 1979	1	2	2	0
	2	3	2	1
	3	0	0	0
	4	1	2	1
	5	0	0	0
	6	0	0	0
July 16 1979	1	0	0	0
	2	2	3	1
	3	0	0	0
	4	1	1	0

a Trial depicted in Figure 6.

b Trial depicted in Figure 5.

vii) The EEG analysis consisted of a coherence study in which pairs of derivations were compared. Each trial of each session was divided into five sections. Each section lasted 24 seconds. One second from these 24 was chosen to make the coherence analysis. To choose this second of activity (point) the only criterion was to find a recording free of artefacts. Thus, if a session had 6 trials, 30 points of analysis were used. We considered this density of analysis to be sufficiently accurate.

Each point in one derivation was compared with each point in all derivations using the following criteria:

- Three parameters were compared; morphology, frequency and phase.
- To measure morphology, the EEG pattern in each point was studied

visually and the amount of correspondence or agreement between patterns decided. A scale from 0 to 50 was constructed in order to quantify the measurement. 50 meant complete identity between patterns and 0 no similarity between EEG patterns.

c) Frequency was measured by counting the number of cycles in each point. If both derivations had exactly the same number of cycles, we assigned the number 30 to that point. If a difference of 5 cycles was found, a number 1 was assigned and if the difference was 10 or more cycles in each point, the number 0 was given.

d) To study phase, we used a scale from 0 to 20. If a similar morphology was found in a point in two derivations, the beginning of each pattern was compared with the beginning of the other pattern. If both patterns began in the same instant, a value of 20 was assigned. If the beginning of one pattern coincided with the end of the other, 0 was assigned.

e) Finally, the coherence value was obtained by adding the values of morphology (50%), frequency (30%) and phase (20%). Thus, a score of 50 in morphology, 30 in frequency and 20 in phase was a 100% coherence. A point with that coherence value was completely identical with another point. A zero coherence value was obtained when both EEG patterns were completely different. The coherence values were compared with the communication values in order to study their relationship. Each pair of inter-hemispheric coherence values were compared and a correlation test was applied to them. These correlation values were also compared with the communication values.

4.6 Third experiment (results)

The final results of this experiment can be summarized as follows: human communication is directly related to the correlation of inter-hemispheric coherences recorded from the brains of the subjects in communication. In other words, two or more subjects communicate with each other when the inter-hemispheric coherence of their brains increase and decrease together. Thus, human communication occurs when the participants in it share their inter-hemispheric brain coherences.

In all the studied cases, when a high correlation between individual inter-hemispheric coherences was obtained, the verbal reports of the resulting communication rated high in our communication scale. Also, when a low correlation between individual inter-hemispheric coherences was obtained, the verbal reports of the resulting communication rated low in our communication scale.

The following figures depict two typical and extreme cases of high and low correlation between temporal derivations.

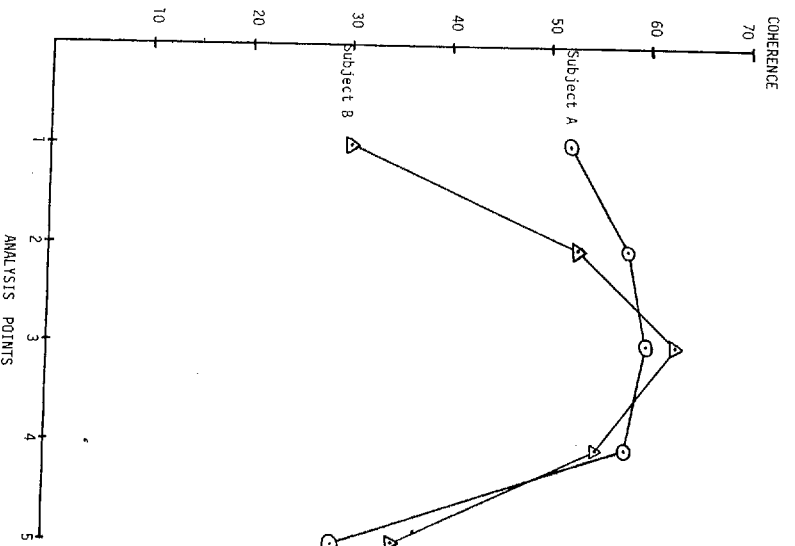


FIGURE 5 Shows the values of the temporal inter-hemispheric coherences of 2 subjects during the communication session of July 16th 1979. A correlation value of 0.96 significant at a $p = 0.05$ was found.

In Figure 5, trial 5 from the July 16th 1979 session is shown.

As can be seen from Table I, this trial was considered as deserving a value of 3 in the scale of communication by the two judges (a direct communication value).

The following is an extract from the reports of the two subjects that were studied during this trial:

Subject A: ... first I saw an image of a sport trophy; a man with his hands up. Later I thought about images. Finally I entered meditation ...

Subject B: ... I let myself go. Then I saw a sport trophy made of gold. A lot of images. Then I saw subject A as he is seated. Finally I saw the gold trophy again ...

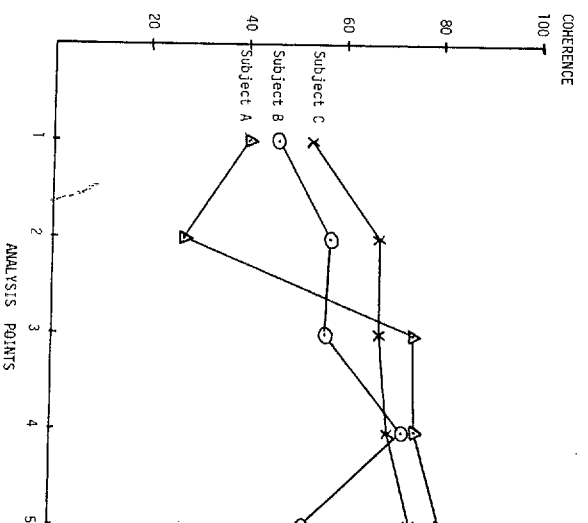


FIGURE 6 Shows the values of the temporal inter-hemispheric coherences of 3 subjects during the communication session held on the 5th of July 1979. The highest correlation value during this session was 0.09.

The statistical non-parametric correlation between the temporal coherences at A and B was 0.96, significant at $p = 0.05$.

In Figure 6, trial 1 from the July 5th 1979 session is shown.

As can be seen from Table I, this trial was rated 0 in the scale of communication by the two judges.

The following is also an extract from the reports during this trial:

Subject A: ... First I was in a state of expectation. Later on I tried to concentrate and to relax. I wanted to feel both B and C (subjects B and C) ...

Subject B: ... I send the image of some planets. Later I opened myself in order to receive some messages ...

Subject C: Disperse thoughts ...

The statistical non-parametric correlation of highest value during this trial was 0.09.

Similar results were obtained for the frontal derivations. Thus, at least under our conditions, the correlation between communication and inter-hemispheric coherence is more global than local and possibly involves the whole cortex.

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Further studies are needed in order to clarify this statement and to extend our results and verify them under conditions similar to and different from ours.

5. GENERAL DISCUSSION

In a related study, I demonstrated that a change in brain coherence was correlated with alterations in gravity. During this experiment, all sessions were conducted in a soundproof, electromagnetically shielded room that contained an inner room resting on rubber cushions to filter and dissipate mechanical vibrations. The chamber was located on the third floor of a highly stable building situated on top of a mountain some 10 km from Mexico City, where the Psychophysiological Laboratories of Anahuac University are housed.

Experiments were conducted during the early evening to avoid noise, mechanical vibrations, and other types of interference. Three boxes fitting within one another were placed in the inner room: (from outside to inside) (i) metal cage; (ii) a Faraday cage; (iii) a wooden box with double walls separated by fibreglass. The metal box was resting on foam rubber and the wooden one was suspended inside the other two so there was no wall contact. Inside the third box a piece of metal weighing 0.1g was suspended from a Grass transducer which was fixed to a metal bar placed on antivibrational sand (Figure 7). The output of the transducer was recorded on a Grass polygraph located in another room.

Nine different subjects ranging in age from 20 to 32 years old (six women and three men) sat on a chair located 100 cm away from the metal box inside the inner room. Bipolar electrodes were used to register frontal EEG activity from both hemispheres, which was also recorded on the Grass polygraph. A sound signal was given as a feedback signal to the subject each time that there was a change in the status of the transducer.

Great care was taken to send a feedback signal only when there was a high degree of security that the changes in the transducer were not caused by mechanical vibrations in the building. Several control periods were recorded in which there were no persons inside the soundproof chamber, in order to monitor the normal fluctuations in the activity of the transducer and to establish baseline activity.

A total of 28 sessions were carried out with the nine subjects over a period of several months and the recordings were analyzed at the end of this time. Each session was empirically divided into two periods: control, when no changes in the output of the transducer were detected, and experimental, when a noticeable change in the transducer was recorded. From 4 to 7 randomly chosen sequences during both periods were analyzed for each session.

Five measurements were made on the selected portions of the recordings:

COMMUNICATION, GRAVITATION AND UNITY

SOUND PROOF ROOM

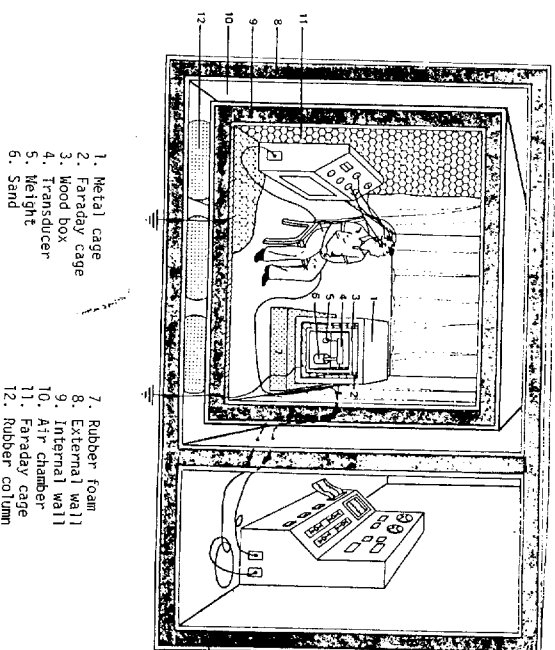


Figure 7 Diagram of the room in which the experiment was held.

FT, frequency of the transducer's signal; VT, voltage of the transducer's signal; FR, frequency of the right frontal EEG recording; FL, frequency of the left frontal EEG recording; and C, coherence between the right and left EEG-frontal recordings. Coherence was graded on a scale of 10 to 0: 10 represented identical morphology, frequency and voltage of both frontal EEG recordings, and 0 signified total dissimilarity.

Whenever a significant change in the transducer's output was recorded, a sound signal was given to the subject who was instructed to use whatever means possible to maintain the sound, with the exception of vocalizations, movements or mechanical vibrations. Each subject participated in a series of sessions with the aim of exploring different techniques for this purpose, but no one was finally able to control voluntarily the weight of the metal object. At the end of each session, the subjects wrote down their experiences and tried to identify the ones correlated with the sound feedback.

In general, a great deal of difficulty in maintaining the sound and even in identifying which experiences were related to its onset were reported. The subjects all agreed that what happened was very difficult to know. This is remarkable, considering the fact that at least two were meditators and one had more than three years of practice in yoga and meditation. Therefore, the first finding is that whatever caused the weight to change is very elusive in terms of conscious experience.

At least half the subjects reported that they felt something but that it was impossible to verbalize. The ineffability of the experience is exemplified in the following statements:

I felt a sense of transparency and peace and the sound appeared when I was trying to do something but I can't say what.

I had a lot of images and suddenly I found the common ground for them; more precisely, what was behind them in terms of explanations. Then, the sound appeared.

This last report is extremely important because it makes clear that an actual change in weight is associated with the bringing into consciousness of formerly unconscious relationships. More often, the subject said that the sound was presented when he felt peaceful and as if there were an internal order, or when he was able to transcend the experimental situation with the accompanying sensation of being inside a soundproof chamber.

The lack of voluntary control over this experience is possibly due to the limited number of sessions held with each subject. Nevertheless, there was a clear increase in the number of sounds that at least one of the subjects was able to activate as he was exposed to the experimental situation (Figure 8). Thus, it appears that the ability to effect gravitational changes can be increased by learning, even if the subjects are not able to verbalize the actual techniques being used.

The mean of all the measurements taken over the 28 sessions are shown in Table II. The most outstanding result is the increase in coherence found when a change in weight was detected (24 out of 28 sessions: $p = 0.00009$ by sign test). Some examples of recordings in which this increase was observed are shown in Figure 9.

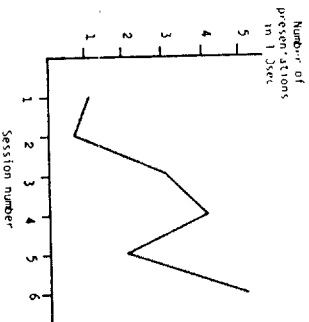


FIGURE 8 The number of presentations of sound feedback signifying a change in the status of the transducer. This increase with the number of sessions, demonstrating a capacity for learning in the subject.

TABLE II
Mean values of EEG coherence, transducer frequency and voltage, and left and right frontal lobe EEG frequency, obtained in the gravitation experiment.

	Control Mean	Experimental Mean
FT - Transducer frequency.	5.821 FT	14.556 FT
VT - Transducer voltage.	0.114 VT	0.470 VT
FR - Right frontal lobe frequency.	16.468 FR	16.240 FR
FL - Left frontal lobe frequency.	16.170 FL	15.531 FL
C - EEG coherence.	0.262 C	0.335 C

Thus, an increase in the coherence of the EEG activity recorded from the frontal lobes of human subjects is correlated with changes in the output of a transducer located 100 cm from the head of the subjects and completely isolated from them. One way of understanding this phenomenon is to suppose that something emerged from the brain capable of passing through a metal box a Faraday isolation chamber, two walls of wood and fibreglass, and reaching the transducer with the weight suspended from it. The possibility that the changes were caused by mechanical vibrations is small due to the construction of the chamber and the transducer, and our controls. Likewise, the alterations were not caused by heat, movement of air, or any other physical forces.

If the explanation given above is true, there are two possible mechanisms by which the weight change might be affected: (i) an increase in brain coherence is able to create an electromagnetic field of such high power and frequency that it is capable of penetrating the objects between the subject and the transducer, or (ii) an increase in coherence causes the structure of space to change, creating gravitational waves. These waves might be produced by a modification in the informational content of the synergetic field resulting from its interaction with a neuronal field.

An increase in coherence is in some sense an increase in redundancy within the brain. One subject stated that the sound signal was elicited by finding a common meaning behind different images. This is in agreement with the possibility of the synergetic theory that a high neurosynergetic brain is capable of approaching a state of unification. It is not known if the changes in coherence are correlated with an increase or decrease in weight, since the transducer is limited to oscillatory responses.

We are now beginning a new experiment using laser technology that will allow us to answer the questions of whether the weight change is caused by an

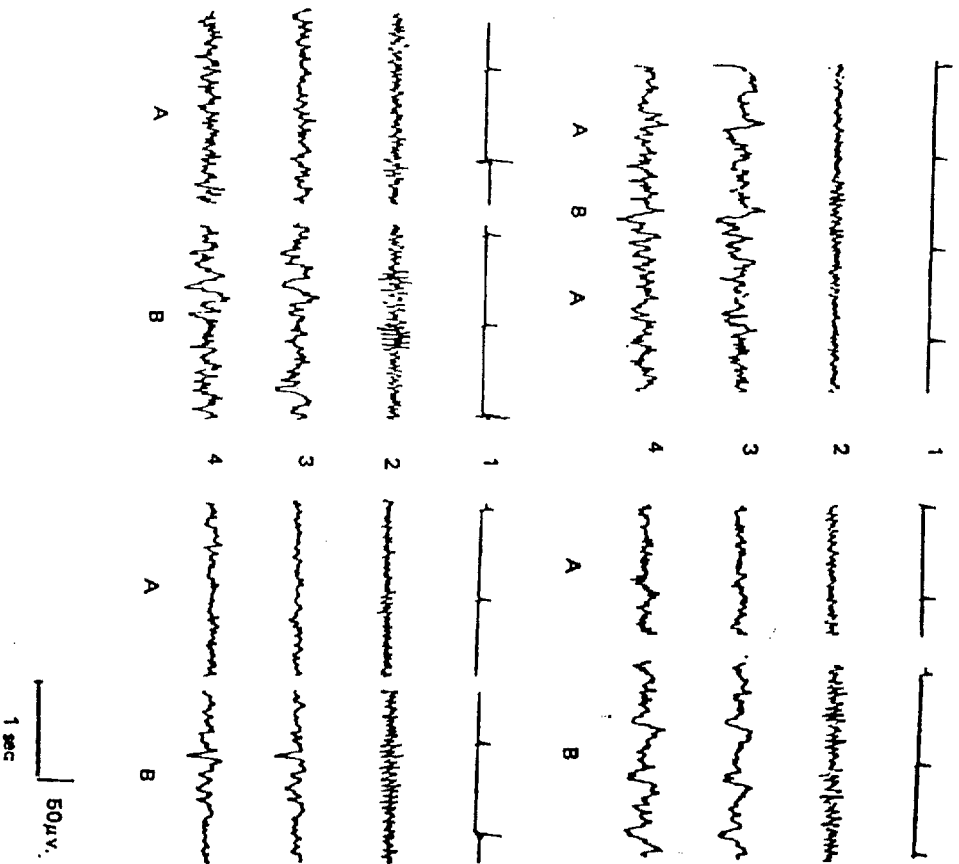


FIGURE 9 Representative recordings from different subjects during control (A) and experimental (B) periods. 1. Time (calibration, 1 sec); 2. Transducer recording; 3. EEG recording from left frontal lobe; 4. EEG recording from right frontal lobe.

electromagnetic field or by a field more directly related to gravitation, and in what direction is the change. Meanwhile, the present results suggest that a brain is capable of altering the energetic structure of the space-matter continuum in a way predicted by the synergetic theory, and that this ability can be augmented by procedures using biofeedback techniques.

Now, in the communication study, similar inter-hemispheric coherence EEG changes are correlated with the level of human communication. The probable meaning of these findings has already been discussed in the theoretical

introduction to this article. Briefly, a neuronal field, the product of all the neuronal interactions in the duration of the present interval is being built inside the brain and later on interacts with the fundamental structure of space. The field is capable of changing the gravitational structure of the space-matter continuum and also interacts with other neuronal fields during communications between human and possibly other beings.

An increase in coherence inside the brain increases the synergetic (see section value of the neuronal field and thus raises the possibility of its interaction with high synergetic fields.

In the experiments reported here, it is clear that communication involves interchange between inter-hemispheric coherences in the brains of the subjects involved in it. Thus, these findings are in agreement with our theoretical postulates. A full agreement requires a close and direct relationship between the level of coherence and the phenomenon of direct communication. In other words, if direct communication occurs when two or more brain inter-hemispheric coherences are interchanged during high individual coherence levels and other types of communication occur while two or more brain inter-hemispheric coherences are interchanged during medium or even low levels of individual coherences, then a high synergetic state is related to unification as our theoretical proclaims.

Obviously, we have tried to make observations about the character of the messages that our subjects interchanged during high, medium and low levels of coherence, but the number of cases in each category was too low to reach a safe conclusion. Nevertheless the few cases that we have studied indicate that a low level of individual coherence is related to messages having more concrete contents and a high level of individual coherence to more abstract levels.

We need other laboratories to become involved in this fascinating field of the physiological correlates of gravitation, unity and human communication in order to reach solid conclusions about these questions. Meanwhile, our results agree with the idea that all of us are One.

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Towards a Physics of Consciousness

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Parallels exist between the quantum mechanical behaviour of electrons in solids and the characteristics of consciousness. For example, similarly to the non-localisation of electrons in a crystal, consciousness at any instant spans all of its current contents and, just as electron events within separate quantum systems are independent of each other, so the consciousness of each individual is private to himself.

Various physiological and biophysical mechanisms have, in the past, been suggested or discovered which might conceivably permit the formation of a unified quantum system in the sensory brain.

If conscious events are quantal events taking place in an extended system, the implication of the time-energy uncertainty principle is that they are always in transition and that the specious present is extended in time. This extension is necessary for the awareness of movement or change and for the ordering of movements into a biography.

The existence of different sensory qualities makes reasonable certain hypotheses about the topological nature of the sensory neural circuitry which is the locus of the above quantal events.

1. INTRODUCTION

The areas of physics known as Optics and Acoustics serve as a reminder that the entire subject has as its raw material human observations. Pearson (1937) claimed that physical laws merely provide brief conceptual formulae that summarise the routine of human perception and, in agreement with him, Einstein (1922) stated that the subject matter of all natural science consists of such sense-perceptions as are common to different individuals and which, therefore, are to some degree impersonal. Although it is true that more recently developed areas, such as electricity, seem often to deal with imperceptibles, it remains the case as Schrödinger (1950) pointed out that all information, however many ingenious devices have been used to facilitate the labour, goes back to the sense perceptions of some living observer. Thus, the physical world (or whatever it is whose effects upon the observer are described by Pearson's "conceptual formulae") is a distillation from sensation. Now, the available evidence suggests that the